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Indian Standard

PROCEDURE FOR INSPECTION AND TESTING OF ALUMINIUM AND ALUMINIUM ALLOY WIRES (FOR RIVETS) FOR AIRCRAFT PURPOSES

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PROCEDURE FOR INSPECTION AND TESTING OF ALUMINIUM AND ALUMINIUM ALLOY WIRES (FOR RIVETS) FOR AIRCRAFT PURPOSES

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(*Continued on page* 9)

Indian Standard

PROCEDURE FOR INSPECTION AND TESTING OF ALUMINIUM AND ALUMINIUM ALLOY WIRES (FOR RIVETS) FOR AIRCRAFT PURPOSES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 23 May 1977, after the draft finalized by the Light Metals and Their Alloys Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 This standard has been prepared to cover inspection and testing requirements for wrought aluminium and aluminium alloy wires for manufacture of rivets used for aircraft purposes.

0.3 In the formulation of this standard, due weightage has also been given to international co-ordination among standards and practices prevailing in different countries in addition to the practices followed in this field in the country. This has been met by deriving assistance from the following overseas specifications:

BS 3L 100	Procedure for inspection and testing of wrought aluminium and aluminium alloys. British Standards Institution.
MIL-W-7986	Wire and rod, aluminium and aluminium alloy, for die heading. U. S. Federal Specification.
AMTY 498	Aluminium alloy wires for cold drawing. State Committee of Aviation Technology of USSR.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS: 2-1960*. The number of signficant places retained in the rounded off value should be the same as that of the specified value in this standard.

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*Rules for rounding of numerical values (*revised*).

1. SCOPE

1.1 This standard covers procedures for inspection and testing of aluminium and aluminium alloy wires used for manufacture of rivets for aircraft purposes.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Approved Scrap — Scrap which is:

a) derived from material the composition of which has been established with regard to the complete range of both the alloying elements and impurity elements appropriate to the class of alloy being made, and

b) segregated and identifiable to the satisfaction of the Inspecting Authority.

2.2 Certification — Confirmation by the manufacturer or supplier that the material conforms to the requirements of the relevant specification, drawing, order or Inspection Schedule.

2.3 Harmful Defect — Any defect prejudicial to the subsequent manufacture, fabrication or use of the material.

2.4 Inspecting Authority — The body responsible for authorizing the manufacturer or supplier to issue certification.

2.5 Inspection Schedule — A schedule of any special test requirements agreed to between the supplier and the purchaser.

2.6 Inspector — The individual responsible for the executive, inspection and release of material.

2.7 Wire — Solid circular section that has been reduced by cold drawing to a diameter up to and including 9 mm.

3. CONDITION

3.1 The material shall be delivered in the condition required by the material specification unless otherwise agreed to between the manufacturer and purchaser and stated in the order.

4. CERTIFICATION

4.1 The manufacturer shall supply to the purchaser the necessary certification in respect of all material governed by this Indian Standard and relevant material specification.

4.2 Except as provided in **4.3**, if any certification is issued by a supplier other than manufacturer, such supplier shall hold the equivalent certification issued by the manufacturer of the material.

4.3 If a batch of material consigned by the manufacturer is subdivided by an approved non-manufacturer before re-consignment, the non-manufacturer shall carry out any consequent additional dimensional inspection and identification marking and shall certify accordingly.

5. MANUFACTURE

5.1 Material shall be made in accordance with the requirements of this Indian Standard and the material specification.

5.2 Wires drawn from each melt shall be made into coils and identified serially from first to the last.

5.3 Cold working/drawing shall be so adjusted as not to lead to grain coarsening on subsequent heat-treatment.

6. FREEDOM FROM DEFECTS

6.1 The material shall be free from harmful defects, such as deep die marks, scratches, scales, exfoliation, blisters, cracks, dents, transverse surface cracking, coarse grained structure, etc.

6.2 Any material may be rejected for faults in manufacture although they conform to chemical composition and mechanical property requirements.

7. DIMENSIONAL TOLERANCES

7.1 The tolerances on the diameter of wire, used for manufacturing rivets, shall be as follows:

Nominal Diameter of Wire mm	*Tolerances on Wire Diameter* mm
From 1·40 up to and including 5·00	± 0·025
Over 5·00 up to and including 9·00	± 0·035

8. CHEMICAL COMPOSITION

8.1 The chemical composition of the material shall comply with the requirements of the material specification. The values stipulated in the specification shall be applied in accordance with the instructions of the Inspecting Authority. Elements not quoted in the specification shall not be added for any purpose other than fluxing, degassing, grain refinement and the like.

8.2 Overall control of the chemical composition and the regulation of the use of scrap shall be such that the method of analytical control adopted for each particular material shall enable the inspector to certify compliance with the requirements of **8.1**.

9. SELECTION OF MECHANICAL TEST SAMPLES

9.1 Coils of wires of the same nominal diameter, from the same cast and, if heat-treated, from the same heat-treatment charge shall be grouped in batches, not exceeding 1 000 kg.

9.2 The Inspector shall select one sample for each test required by the material specification, from one end of the first, last and an intermediate coil of each batch. When this procedure is not possible, the sample shall be selected from at least 10 percent of the coils and in any case not less than 2 coils in each batch.

10. PREPARATION OF MECHANICAL TEST SPECIMENS

10.1 Test specimens are used unmachined in accordance with IS: 1816-1961* the percentage elongation is not to be determined, the length of test specimen is not important provided there is a length of at least 10 cm between the grips of the testing machine and failure does not occur at the grips. Test results obtained when the failure occurs at the grips shall be discarded.

10.2 Test samples selected in accordance with **9** shall not be subjected to any mechanical working, except for straightening after having been separated from the batch material.

10.3 If appropriate, the test samples shall be subjected to heat-treatment in accordance with material specification before being tested.

11. MECHANICAL TEST†

11.1 Tensile Test — Test specimens prepared in accordance with the requirements of **10** from test samples selected in accordance with **9** shall satisfy the tensile test requirements of the material specification, when tested in accordance with IS : 1816-1961*.

11.2 Torsion Test — Test specimens prepared in accordance with the requirements of **10** from test samples selected in accordance with **9** shall satisfy the torsion test requirements of material specification, when tested as follows:

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*Method for tensile test for light metals and their alloys.

†The particular test(s) stipulated in the material specifications only need be carried out.

> A length of wire shall be gripped in two jaws 150 mm apart, one of which shall be free to rotate; the other end shall not rotate but may be free to move longitudinally during the test. The free end shall be turned 6 times through 360° and then shall be turned the same number of turns, through 360° in the opposite direction. No defect detrimental to cold forging shall be visible in the wire after the test.

11.3 Retest

11.3.1 If any test specimen fails to satisfy the mechanical test requirements, the inspector shall adopt one or both of the following procedures as requested by the manufacturer:

a) Select for test from the same batch two further samples one of which shall be from the wire originally selected and from a position adjacent to that occupied by the original sample, unless that wire has been withdrawn by the manufacturer. Test specimens prepared from both these further samples shall satisfy the relevant test requirements.

b) If appropriate, allow the batch to be re-heat-treated in accordance with the material specification and retested in accordance with the requirements of **9** and **10**.

11.3.2 *First and Last Coils of a Batch* — If any of the retest specimens from first or last coil in a batch fails to satisfy the requirements of the material specification, the particular coils shall be rejected and retest carried out (on the subsequent coil in the case of failure from first coil and previous coil in the cases of last coil). If both retest specimens from the coil fails, the entire batch shall be rejected.

11.3.3 *Retest Specimens from Intermediate Coil* — If both retest specimens fail to satisfy the requirements of the material specification, the entire batch shall be rejected.

12. UPSETTING TEST

12.1 Samples for upsetting test shall be selected and prepared in accordance with **9** and **10**.

12.2 Upsetting test shall be carried out in the following conditions:

a) In as supplied condition, and

b) After solution treatment within a specified time limit as given in the material specification for heat treatable alloys.

12.3 The upsetting test shall be carried out under press in a riveting fixture with the following set up:

Diameter of the Wire	*Length of the Test Specimen Held in the Fixture*	*Height of the Projecting Portion of Test Specimen*	*Permissible Gap Between the Specimen and the Hole*
mm	mm		mm
Over 1·4 to 3·0 (including)	3	As given in the material specification	0·10
Over 3·0 „ 6·0 (including)	5		0·10
Over 6·0 „ 8·0 (including)	5·5		0·15
Over 8·0 „ 9 (including)	7·5		0·15

12.3.1 Upsetting shall be done under a press till a flat head of height not more than half the diameter of the wire is obtained. The formed head should have circular or slightly oval shape, concentric with the shank. The sides shall be smooth and free from cracks. If the cracks appear on the formed head before the height is compressed to half the diameter of the wire, the piece shall be discarded and the test repeated.

12.4 If the upsetting test fails*, it shall be repeated on two further test specimens from the same end of the coils from which original samples were selected. If any of the retest fails the coil represented by it shall be rejected and upsetting test carried out on all the remaining coils of the batch.

13. IDENTIFICATION

13.1 Wires in straight lengths, of the same diameter from the same cast and if appropriate, from the same heat-treatment batch, passed by the Inspector shall have attached a durable label bearing the mark of the Inspector and such other markings as shall ensure full identification of the material.

13.2 Each coil marked by the Inspector shall have attached a durable label bearing the mark of the Inspector and such other markings as shall ensure full identification of the material.

13.3 Each bundle and each coil of wire shall be colour coded in accordance with the material specification, to the satisfaction of the Inspecting Authority.

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*If the failure is suspected to be due to any defect in testing method, specimen shall be discarded and testing carried out on a fresh specimen.

(*Continued from page* 2)

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Conversion*
Force	newton	N	1 N = 1 kg.1 m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2